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(54) GLASS COMPOSITION

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a composition high in productivity and improved in specific Young's modulus of glass by specifying a composition range of SiO2, Al2O3, MgO and Li2O.
SOLUTION: The composition is composed of 54.5-59.5 wt.% SiO2, 10-30 wt.% Al2O3, 10-30 wt.% MgO and 3-12 wt.% Li2O. In the production method of the glass, after mixing the starting material containing main component composition of a glass substrate formed lastly in a prescribed proportion, the starting material is put into a platinum crucible and fused. After fusing the mixture and after forming a general shape by casting the fused matter into a mold, the formed matter is annealed to room temp. Then after forming a crystalline nucleus by holding at the primary heat treating temp. for the primary treating time, the crystalline nucleus is grown by holding at a prescribed secondary heat treating temp. for the secondary treating time, and the crystalline nucleus is cooled slowly to obtain an objective crystallized glass. The glass composition is especially suitable to a crystallized glass magnetic disk, and the glass substrate having the specific Young's modulus not less than 33 and high in productivity is obtained.

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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] the presentation range of a principal component -- SiO2 -- more than 54.5wt% -- and -- less than [59.5wt%] and aluminum 2O3 -- more than 10wt% -- and -- less than [30wt%] and MgO -- more than 10wt% -- and -- less than [30wt%] and Li2O -- more than 3wt% -- and -- Glass presentation characterized by considering as less than [12wt%].

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a glass presentation, especially the glass presentation suitable for glass ceramics. It is related with the presentation of a crystallization glass magnetic disk in more detail.
[0002]
[Description of the Prior Art] Conventionally, the aluminum substrate, the glass substrate, etc. are put in practical use as a substrate for magnetic disks. The glass substrate attracts attention most from surface smooth nature and a surface mechanical strength being excellent especially. As such a glass substrate, the chemically-strengthened-glass substrate which strengthened the glass substrate front face with the ion exchange, and the glass-ceramics substrate which a crystal component is deposited in a substrate and strengthens association are known.
[0003]
[Problem(s) to be Solved by the Invention] By the way, the demand of the engine performance to the latest substrate is becoming severe day by day, and the improvement in the engine performance to the reinforcement especially concerned with the deflection and camber at the time of high-speed rotation directly is called for. The specific Young's modulus (= Young's modulus / specific gravity) of a substrate ingredient can express it, and as this has a high numeric value, it is more desirable. Moreover, improvement in productivity is called for, filling such a demand. Then, the specific Young's modulus of this invention of glass improves, and it aims at offering a presentation for high ** of productivity further.
[0004]
[Means for Solving the Problem] invention indicated by claim 1 in order to attain the above-mentioned purpose -- the presentation range of a principal component -- SiO2 -- more than 54.5wt% -- and -- less than [59.5wt%] and aluminum 2O3 -- more than 10wt% -- and -- less than [30wt%] and MgO -- more than 10wt% -- and -- less than [30wt%] and Li2O -- more than 3wt% -- and -- It is characterized by making it less than [12wt%].
[0005]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained. the glass substrate of the operation gestalt concerning this invention -- the presentation range of a principal component -- SiO2 -- more than 54.5wt% -- and less than [59.5wt%] and aluminum 2O3 -- more than 10wt% -- and less than [30wt%] and MgO -- more than 10wt% -- and less than [30wt%] and Li2O -- more than 3wt% -- and it is characterized by being less than [12wt%].
[0006] Since melting nature will worsen if SiO2 has few presentation ratios than 54.5wt(s)% because of a glass forming oxide, and it will be in a stable state as glass if 59.5wt% is exceeded, a crystal stops being able to deposit easily.
[0007] aluminum 2O3 is a glass intermediate oxide, and is the constituent of the boric-acid aluminum system crystal which deposits by heat treatment and which is a crystal phase. When there are few presentation ratios than 10wt(s)%, there are few deposit crystals, reinforcement is not obtained, but if 30wt% is exceeded, melting temperature will become high and it will become

easy to devitrify.
[0008] MgO is a fusing agent, makes a granular crystal condense and forms crystal particle mass. however, if there are few presentation ratios than 10wt(s)%, working temperature width of face can become narrow, and the chemical durability of a glass matrix phase will not improve. If 30wt (s)% is exceeded, it will become difficult to obtain the reinforcement for which other crystal phases deposit and it asks.
[0009] Li2O is a fusing agent and its stability at the time of production is improving. If there are few presentation ratios than 3wt(s)%, melting nature will worsen, and if 12wt% is exceeded, the stability in a polish-washing process will worsen.
[0010] The manufacture approach is explained below. Predetermined boils comparatively a raw material including the presentation of the principal component of the glass substrate finally generated, it fully mixes, this is put into a platinum crucible, and melting is performed. The configuration of a sink outline is formed in melting backward metal mold. This is annealed to a room temperature. Then, it holds by the primary heat treatment temperature and the primary processing time which are shown (heat treatment), and crystal nucleation is performed. Then, it holds by secondary heat treatment temperature and secondary treatment time amount, and crystalline-nucleus growth is performed. The target glass ceramics are obtained by carrying out gradual cooling of this.
[0011] the glass substrate obtained by the above manufacture approach -- SiO2 -- more than 54.5wt% -- and less than [59.5wt%] and aluminum 2O3 -- more than 10wt% -- and less than [30wt%] and MgO -- more than 10wt% -- and less than [30wt%] and Li2O -- more than 3wt% -- and in order to consider as less than [12wt%], it became possible to acquire a very high specific Young's modulus and high productivity.
[0012]
[Example] Next, the concrete example which carried out the operation gestalt is explained. The ingredient presentation ratio (unit: wt%) and melting temperature which constitute the glass of the 1st - the 5th example, melting time amount and primary heat treatment temperature, the primary processing time and secondary heat treatment temperature, secondary treatment time amount, the main deposit crystal phase, a subdeposit crystal phase, the diameter of average crystal grain and specific gravity, Young's modulus, and a specific Young's modulus are shown in Table 1. The glass of the 6th - the 10th example is similarly shown in Table 2. The glass of the 11th - the 15th example is similarly shown in Table 3. The glass of the 16th - the 20th example is similarly shown in Table 4.
[0013]
[Table 1]

	実施例1	実施例2	実施例3	実施例4	実施例5
SiO2	51.6	54.7	54.2	50.0	52.0
Al2O3	17.0	13.7	18.0	24.2	26.5
MgO	16.4	12.8	23.8	20.1	17.1
P2O5	1.7	1.6	0.2	1.2	
Nb2O5					2.0
Ta2O5					
Li2O	2.9	4.1	3.8	4.5	2.4
TiO2	8.2	7.4			
ZrO2					
B2O3					
Y2O3		3.7			
K2O	1.8	1.6			
Sb2O3	0.5	0.4			
ZnO					
La2O3					
計	100.0	100.0	100.0	100.0	100.0
溶融温度	1300	1250	1350	1350	1350
溶融時間	5.00	5.00	5.50	5.50	5.50
1次熱処理温	640	640	670	670	670
1次処理時間	5.00	5.00	5.50	5.50	5.50
2次熱処理温	710	700	730	730	730
2次処理時間	4.50	4.50	5.00	5.00	5.00
主析出結晶相	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート
副析出結晶相	ルチル	ルチル			
結晶粒径	0.05	0.05	0.05	0.05	0.05
比重:g/cm3	2.64	2.67	2.68	2.62	2.74
ヤング率E:GP	96.04	94.21	99.04	94.04	99.04
比弾性率	36.32	35.35	36.90	35.84	36.09

[0014]
[Table 2]

	実施例6	実施例7	実施例8	実施例9	実施例10
SiO2	48.0	54.0	52.2	52.2	48.0
Al2O3	19.8	16.8	21.6	28.2	18.5
MgO	23.0	24.0	14.8	17.2	27.5
P2O5					
Nb2O5	4.0				
Ta2O5		2.2	5.2		
Li2O	5.2	3.0	6.2	2.4	6.0
TiO2					
ZrO2					
B2O3					
Y2O3					
K2O					
Sb2O3					
ZnO					
La2O3					
計	100.0	100.0	100.0	100.0	100.0
溶融温度	1350	1350	1350	1350	1350
溶融時間	5.50	5.50	5.50	5.50	5.50
1次熱処理温	670	670	670	670	670
1次処理時間	5.50	5.50	5.50	5.50	5.50
2次熱処理温	730	730	730	730	730
2次処理時間	5.00	5.00	5.00	5.00	5.00
主析出結晶相	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート
副析出結晶相					
結晶粒径	0.05	0.05	0.05	0.05	0.05
比重:g/cm3	2.76	2.79	2.76	2.68	2.72
ヤング率E:GP	101.04	101.04	104.04	108.04	106.04
比弾性率	36.56	36.16	37.64	40.25	38.93

[0015]
[Table 3]

	実施例11	実施例12	実施例13	実施例14	実施例15
SiO2	49.5	48.5	53.2	50.5	53.2
Al2O3	20.0	19.5	21.0	23.6	22.2
MgO	22.0	17.5	22.5	14.5	20.6
P2O5					
Nb2O5					
Ta2O5					
Li2O	4.5	5.5	2.8	7.2	3.5
TiO2	4.0	9.0			
ZrO2			0.5	4.2	
B2O3					0.5
Y2O3					
K2O					
Sb2O3					
ZnO					
La2O3					
計	100.0	100.0	100.0	100.0	100.0
溶融温度	1350	1350	1350	1350	1300
溶融時間	5.50	5.50	5.50	5.50	5.00
1次熱処理温	670	670	670	670	640
1次処理時間	5.50	5.50	5.50	5.50	5.00
2次熱処理温	730	730	730	730	710
2次処理時間	5.00	5.00	5.00	5.00	4.50
主析出結晶相	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート
副析出結晶相	ルチル	ルチル			
結晶粒径	0.05	0.05	0.05	0.05	0.05
比重:g/cm3	2.96	2.99	2.89	2.92	2.64
ヤング率E:GP	109.24	108.24	104.04	104.24	96.04
比弾性率	36.86	36.15	35.95	35.65	36.32

[0016]
[Table 4]

	実施例16	実施例17	実施例18	実施例19	実施例20
SiO2	54.8	52.0	50.0	48.2	48.5
Al2O3	19.8	27.3	12.0	25.9	14.0
MgO	16.0	16.2	26.7	19.8	23.0
P2O5					
Nb2O5					
Ta2O5					
Li2O	6.2	2.7	7.1	2.4	4.0
TiO2					
ZrO2					
B2O3	3.2				
Y2O3		1.8	4.2		
K2O				1.0	4.0
Sb2O3				0.2	2.0
ZnO				0.5	2.0
La2O3				2.0	2.5
計	100.0	100.0	100.0	100.0	100.0
溶融温度	1300	1350	1350	1300	1300
溶融時間	5.00	5.50	5.50	5.50	5.50
1次熱処理温	640	670	670	640	640
1次処理時間	5.00	5.50	5.50	5.50	5.50
2次熱処理温	710	730	730	710	710
2次処理時間	4.50	5.00	5.00	5.00	5.00
主析出結晶相	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート	マグネシウムアルミノシリケート
副析出結晶相					
結晶粒径	0.05	0.05	0.05	0.05	0.05
比重:g/cm3	2.64	2.92	2.96	2.96	2.99
ヤング率E:GP	96.04	110.04	112.04	103.04	106.04
比弾性率	36.32	37.63	37.80	34.78	35.42

[0017] the glass presentation of the 1st example -- SiO2 -- it is [aluminum / 2O3 / MgO / 5 / P2O/ O / Li2] a 0.3wt(s)% presentation ratio about Sb 2O3 6.9wt(s)% in TiO2 3wt(s)% 2wt(s)% 11.2wt(s)% 18.1wt(s)% 54.5wt(s)%.

[0018] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 710 secondary treatment temperature and secondary treatment time amount 4.5 hours for 640 primary processing temperature, and primary processing-time 5 hours for 1200 melting temperature, and melting time amount 3.5 hours according to the above-mentioned manufacture approach, the glass substrate of the property [crystal phase / main deposit / crystal phase / magnesium alumina silicate and / subdeposit / specific Young's modulus] 36.12 was obtained by the rutile. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0019] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, P2O5 which work as a fusing agent are added, and it is the nucleation agent which deposits a silicate system crystal, and it is an important component in order to deposit a crystal in homogeneity on the whole glass. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure becomes is hard to be acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. If 9wt(s)% is exceeded, since the increase of reactivity over a furnace agent and devitrification nature at the time of melting also become strong, the productivity at the time of melting shaping will fall. Moreover, chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process worsens.

[0020] Moreover, since TiO2 which works as a fusing agent is added, the stability at the time of

production is improving. If there are few presentation ratios than 0.1wt(s)%, while melting nature will worsen, if it is hard coming to carry out crystal growth and 12wt% is exceeded, crystallization will be promoted rapidly, it becomes that control of a crystallization condition is difficult, and the heterogeneity of big-and-rough-izing of a deposit crystal and a crystal phase generates, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. It furthermore becomes easy to devitrify at the time of melting shaping, and productivity falls.

[0021] Moreover, since Sb 2O3 which works as a clarifier is added, the stability at the time of production is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient founding effectiveness will no longer be acquired and productivity will fall. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.

[0022] the glass presentation of the 2nd example -- SiO2 -- 54.9wt(s)% and aluminum 2O3 -- 13.7wt(s)% and MgO -- it is [5 / P2O/ O / Li2/ TiO /2 / 3 / Y2O] a 0.4wt(s)% presentation ratio about Sb 2O3 1.7wt(s)% in K2O 3.7wt(s)% 7.4wt(s)% 5.1wt(s)% 1.6wt(s)% 11.5wt(s)%.

[0023] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 4.5 hours for 670 primary processing temperature, and primary processing-time 5 hours for 1200 melting temperature, and melting time amount 3.5 hours according to the above-mentioned manufacture approach, the glass substrate of the property [crystal phase / main deposit / crystal phase / magnesium alumina silicate and / subdeposit / specific Young's modulus] 36.21 was obtained by the rutile. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0024] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, P2O5 which work as a fusing agent are added, and it is the nucleation agent which deposits a silicate system crystal, and it is an important component in order to deposit a crystal in homogeneity on the whole glass. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure becomes is hard to be acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. If 9wt(s)% is exceeded, since the increase of reactivity over a furnace agent and devitrification nature at the time of melting also become strong, the productivity at the time of melting shaping will fall. Moreover, chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process worsens.

[0025] Moreover, since TiO2 which works as a fusing agent is added, the stability at the time of production is improving. If there are few presentation ratios than 0.1wt(s)%, while melting nature will worsen, if it is hard coming to carry out crystal growth and 12wt% is exceeded, crystallization will be promoted rapidly, it becomes that control of a crystallization condition is difficult, and the heterogeneity of big-and-rough-izing of a deposit crystal and a crystal phase generates, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. It furthermore becomes easy to devitrify at the time of melting shaping, and productivity falls.

[0026] Moreover, since Y2O3 which work as a fusing agent are added, rigidity is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be obtained. If 9wt(s)% is exceeded, a crystal deposit will be controlled, sufficient degree of crystallinity will not be obtained, and a desired property will not be attained.

[0027] Moreover, since K2O which works as a fusing agent is added, the stability at the time of production is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient melting nature improvement will not be made. If 5wt(s)% is exceeded, glass becomes stable, and crystallization is controlled, and chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process will worsen.

[0028] Moreover, since Sb 2O3 which works as a clarifier is added, the stability at the time of production is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient

founding effectiveness will no longer be acquired and productivity will fall. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0029] The glass presentation of the 3rd example is [2 / SiO/ aluminum / 2O3 / MgO] a 3.1wt (s)% presentation ratio about Li2O 0.2wt(s)% in P2O5 20.7wt(s)% 18wt(s)% 58wt(s)%.
[0030] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 36.70 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0031] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, P2O5 which work as a fusing agent are added, and it is the nucleation agent which deposits a silicate system crystal, and it is an important component in order to deposit a crystal in homogeneity on the whole glass. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure becomes is hard to be acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. If 9wt(s)% is exceeded, since the increase of reactivity over a furnace agent and devitrification nature at the time of melting also become strong, the productivity at the time of melting shaping will fall. Moreover, chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process worsens.
[0032] The glass presentation of the 4th example is [2 / SiO/ aluminum / 2O3 / MgO] a 6.7wt (s)% presentation ratio about Li2O 1.2wt(s)% in P2O5 17.9wt(s)% 19.2wt(s)% 55wt(s)%.
[0033] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.64 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0034] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, P2O5 which work as a fusing agent are added, and it is the nucleation agent which deposits a silicate system crystal, and it is an important component in order to deposit a crystal in homogeneity on the whole glass. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure becomes is hard to be acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. If 9wt(s)% is exceeded, since the increase of reactivity over a furnace agent and devitrification nature at the time of melting also become strong, the productivity at the time of melting shaping will fall. Moreover, chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process worsens.
[0035] The glass presentation of the 5th example is [2 / SiO/ aluminum / 2O3 / MgO] a 3.1wt (s)% presentation ratio about Li2O 2wt(s)% in Nb 2O5 11.2wt(s)% 26.5wt(s)% 57.2wt(s)%.
[0036] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main

deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.90 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0037] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, Nb 2O5 which works as a fusing agent is added, and the crystalline-nucleus agent matter will increase. [moreover,] However, if there are few presentation ratios than 0.1wt (s)%, sufficient rigid improvement will not be made. If 9wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0038] The glass presentation of the 6th example is [2 / SiO/ aluminum / 2O3 / MgO] a 8.5wt (s)% presentation ratio about Li2O 4wt(s)% in Nb 2O5 16wt(s)% 16.9wt(s)% 54.6wt(s)%.
[0039] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 36.36 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0040] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, Nb 2O5 which works as a fusing agent is added, and the crystalline-nucleus agent matter will increase. [moreover,] However, if there are few presentation ratios than 0.1wt (s)%, sufficient rigid improvement will not be made. If 9wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0041] The glass presentation of the 7th example is [2 / SiO/ aluminum / 2O3 / MgO] a 3.4wt (s)% presentation ratio about Li2O 2.2wt(s)% in Ta 2O5 24wt(s)% 15.6wt(s)% 54.8wt(s)%.
[0042] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.97 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0043] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since Ta 2O5 which works as a fusing agent is added, melting nature and reinforcement are raised, and the chemical durability of a glass matrix phase is raised.
[moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be made. If 9wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0044] The glass presentation of the 8th example is [2 / SiO/ aluminum / 2O3 / MgO] a 5.2wt (s)% presentation ratio about Li2O 5.2wt(s)% in Ta 2O5 16.2wt(s)% 15wt(s)% 58.4wt(s)%.
[0045] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 37.45 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0046] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since Ta 2O5 which works as a fusing agent is added, melting nature and

reinforcement are raised, and the chemical durability of a glass matrix phase is raised.
[moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be made. If 9wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0047] The glass presentation of the 9th example is [2 / SiO/ aluminum / 2O3] a 3wt(s)% presentation ratio about Li2O 14.3wt(s)% in MgO 28wt(s)% 54.7wt(s)%.
[0048] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 40.06 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0049] The glass presentation of the 10th example is [2 / SiO/ aluminum / 2O3] a 6wt(s)% presentation ratio about Li2O 20.3wt(s)% in MgO 15.7wt(s)% 58wt(s)%.
[0050] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 38.74 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0051] The glass presentation of the 11th example is [2 / SiO/ aluminum / 2O3 / MgO] a 4wt (s)% presentation ratio about TiO2 3.5wt(s)% in Li2O 18.4wt(s)% 19.2wt(s)% 54.9wt(s)%.
[0052] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property [crystal phase / main deposit / crystal phase / magnesium alumina silicate and / subdeposit / specific Young's modulus] 36.68 was obtained by the rutile. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0053] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since TiO2 which works as a fusing agent is added, the stability at the time of production is improving. [moreover,] If there are few presentation ratios than 0.1wt(s)%, while melting nature will worsen, if it is hard coming to carry out crystal growth and 12wt% is exceeded, crystallization will be promoted rapidly, it becomes that control of a crystallization condition is difficult, and the heterogeneity of big-and-rough-izing of a deposit crystal and a crystal phase generates, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. It furthermore becomes easy to devitrify at the time of melting shaping, and productivity falls.
[0054] The glass presentation of the 12th example is [2 / SiO/ aluminum / 2O3 / MgO] a 9wt (s)% presentation ratio about TiO2 5.4wt(s)% in Li2O 10.5wt(s)% 16.1wt(s)% 59wt(s)%.
[0055] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property [crystal phase / main deposit / crystal phase / magnesium alumina silicate and / subdeposit / specific Young's modulus] 35.97 was obtained by the rutile. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0056] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since TiO2 which works as a fusing agent is added, the stability at the time of production is improving. [moreover,] If there are few presentation ratios than 0.1wt(s)%, while melting nature will worsen, if it is hard coming to carry out crystal growth and 12wt% is exceeded, crystallization will be promoted rapidly, it becomes that control of a crystallization condition is difficult, and the heterogeneity of big-and-rough-izing of a deposit crystal and a crystal phase generates, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. It furthermore becomes easy to devitrify at the time of melting shaping, and productivity falls.
[0057] The glass presentation of the 13th example is [2 / SiO/ aluminum / 2O3 / MgO] a 0.5wt (s)% presentation ratio about ZrO2 3.1wt(s)% in Li2O 20.2wt(s)% 21wt(s)% 55.2wt(s)%.
[0058] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.77 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0059] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since ZrO2 which works as a glass modifier oxide is added, the crystalline-nucleus agent of glass functions effectively. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. Moreover, chemical durability and migration-proof fall, and while there is a possibility of affecting the magnetic film, stability worsens in a polish-washing process. Moreover, if 12wt(s)% is exceeded, melting temperature will become high, and it becomes easy to devitrify and melting shaping becomes difficult. Moreover, the property which a deposit crystal phase changes and is searched for becomes is hard to be acquired.
[0060] The glass presentation of the 14th example is [2 / SiO/ aluminum / 2O3 / MgO] a 4.2wt (s)% presentation ratio about ZrO2 6.4wt(s)% in Li2O 12.2wt(s)% 18.8wt(s)% 58.4wt(s)%.
[0061] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.47 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0062] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since ZrO2 which works as a glass modifier oxide is added, the crystalline-nucleus agent of glass functions effectively. [moreover,] If there are few presentation ratios than 0.1wt(s)%, sufficient crystalline nucleus will become is hard to be formed, a crystal grain child makes it big and rough, or a crystal deposits in heterogeneity, a detailed and homogeneous crystal structure is no longer acquired, and a smooth side required as a disk substrate is no longer acquired in polish processing. Moreover, chemical durability and migration-proof fall, and while there is a possibility of affecting the magnetic film, stability worsens in a polish-washing process. Moreover, if 12wt(s)% is exceeded, melting temperature will become high, and it becomes easy to devitrify and melting shaping becomes difficult. Moreover, the property which a deposit crystal phase changes and is searched for becomes is hard to be acquired.
[0063] The glass presentation of the 15th example is [2 / SiO/ O / aluminum2/ MgO] a 0.5wt (s)% presentation ratio about B-2 O3 3.3wt(s)% in Li2O 21.6wt(s)% 20wt(s)% 54.6wt(s)%.
[0064] As a result of preparing a raw material so that the above-mentioned presentation ratio

may be included, and taking a measure in 710 secondary treatment temperature and secondary treatment time amount 4.5 hours for 640 primary processing temperature, and primary processing-time 5 hours for 1200 melting temperature, and melting time amount 3.5 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 36.12 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0065] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since B-2 O3 which works as a former is added, the phase separation of glass is urged, and a crystal deposit and growth are promoted. [moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient melting nature improvement will not be made. If 5wt(s)% is exceeded, while it will become easy to devitrify glass and shaping will become difficult, a crystal makes it big and rough and a detailed crystal is no longer obtained.

[0066] The glass presentation of the 16th example is [2 / SiO/ O / aluminum2/ MgO] a 3.2wt (s)% presentation ratio about B-2 O3 4.2wt(s)% in Li2O 16wt(s)% 20.4wt(s)% 56.2wt(s)%.

[0067] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 710 secondary treatment temperature and secondary treatment time amount 4.5 hours for 640 primary processing temperature, and primary processing-time 5 hours for 1200 melting temperature, and melting time amount 3.5 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 36.12 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0068] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since B-2 O3 which works as a former is added, the phase separation of glass is urged, and a crystal deposit and growth are promoted. [moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient melting nature improvement will not be made. If 5wt(s)% is exceeded, while it will become easy to devitrify glass and shaping will become difficult, a crystal makes it big and rough and a detailed crystal is no longer obtained.

[0069] The glass presentation of the 17th example is [2 / SiO/ O / aluminum2/ MgO] a 1.8wt (s)% presentation ratio about Y2O3 3.2wt(s)% in Li2O 16.2wt(s)% 22.6wt(s)% 56.2wt(s)%.

[0070] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 37.45 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0071] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since Y2O3 which work as a fusing agent are added, rigidity is improving. [moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be obtained. If 9wt(s)% is exceeded, a crystal deposit will be controlled, sufficient degree of crystallinity will not be obtained, and a desired property will not be attained.

[0072] The glass presentation of the 18th example is [2 / SiO/ O / aluminum2/ MgO] a 4.2wt (s)% presentation ratio about Y2O3 5.2wt(s)% in Li2O 20.1wt(s)% 12wt(s)% 58.5wt(s)%.

[0073] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 730 secondary treatment temperature and secondary treatment time amount 5 hours for 670 primary processing temperature, and primary processing-time 5.5 hours for 1250 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 37.62 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.

[0074] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since Y2O3 which work as a fusing agent are added, rigidity is improving. [moreover,] However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be obtained. If 9wt(s)% is exceeded, a crystal deposit will be controlled, sufficient degree of crystallinity will not be obtained, and a desired property will not be attained.
[0075] the glass presentation of the 19th example -- SiO2 -- 54.5wt(s)% and aluminum 2O3 -- it is [MgO / O / Li2/ O / K2/ Sb / 2O3] a 2wt(s)% presentation ratio about La 2O3 0.5wt(s)% in ZnO 0.2wt(s)% 1wt% 3.3wt(s)% 18.5wt(s)% 20wt(s)%.
[0076] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 710 secondary treatment temperature and secondary treatment time amount 5 hours for 640 primary processing temperature, and primary processing-time 5.5 hours for 1200 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 34.58 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0077] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since K2O which works as a fusing agent is added, the stability at the time of production is improving. [moreover,] However, if there are few presentation ratios than 0.1wt (s)%, sufficient melting nature improvement will not be made. If 5wt(s)% is exceeded, glass becomes stable, and crystallization is controlled, and chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process will worsen.
[0078] Moreover, since Sb 2O3 which works as a clarifier is added, the stability at the time of production is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient founding effectiveness will no longer be acquired and productivity will fall. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0079] Moreover, since ZnO which works as a fusing agent is added, a uniform crystal deposit is assisted. However, if there are few presentation ratios than 0.1wt(s)%, an improvement of sufficient crystal homogenization will not be made. If 5wt(s)% is exceeded, glass becomes stable, crystallization will be controlled and the reinforcement for which it asks will become is hard to be obtained.
[0080] Moreover, since La 2O3 which works as a fusing agent is added, a crystal deposit is controlled. However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be made. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0081] the glass presentation of the 20th example -- SiO2 -- 59wt(s)% and aluminum 2O3 -- it is [MgO / O / Li2/ O / K2/ Sb / 2O3] a 2.5wt(s)% presentation ratio about La 2O3 2wt(s)% in ZnO 2wt(s)% 4wt(s)% 4wt(s)% 15.3wt(s)% 11.2wt(s)%.
[0082] As a result of preparing a raw material so that the above-mentioned presentation ratio may be included, and taking a measure in 710 secondary treatment temperature and secondary treatment time amount 5 hours for 640 primary processing temperature, and primary processing-time 5.5 hours for 1200 melting temperature, and melting time amount 4 hours according to the above-mentioned manufacture approach, the glass substrate of the property which the main deposit crystal phase calls magnesium alumina silicate, and a specific Young's modulus calls 35.24 was obtained. The above-mentioned presentation not only has a high specific Young's modulus, but has very high productivity.
[0083] SiO2 and aluminum2 which are a basic presentation as a presentation -- O3, MgO, and Li2O -- in addition, since K2O which works as a fusing agent is added, the stability at the time of production is improving. [moreover,] However, if there are few presentation ratios than 0.1wt (s)%, sufficient melting nature improvement will not be made. If 5wt(s)% is exceeded, glass becomes stable, and crystallization is controlled, and chemical durability falls, and while there is a possibility of affecting the magnetic film, the stability in a polish-washing process will worsen.

[0084] Moreover, since Sb 2O3 which works as a clarifier is added, the stability at the time of production is improving. However, if there are few presentation ratios than 0.1wt(s)%, sufficient founding effectiveness will no longer be acquired and productivity will fall. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0085] Moreover, since ZnO which works as a fusing agent is added, a uniform crystal deposit is assisted. However, if there are few presentation ratios than 0.1wt(s)%, an improvement of sufficient crystal homogenization will not be made. If 5wt(s)% is exceeded, glass becomes stable, crystallization will be controlled and the reinforcement for which it asks will become is hard to be obtained.
[0086] Moreover, since La 2O3 which works as a fusing agent is added, a crystal deposit is controlled. However, if there are few presentation ratios than 0.1wt(s)%, sufficient rigid improvement will not be made. If 5wt(s)% is exceeded, crystallization of glass will become unstable and the property which it becomes impossible to control a deposit crystal phase, and is searched for will become is hard to be acquired.
[0087]
[Effect of the Invention] According to this invention, a specific Young's modulus can obtain 33 or more and a glass substrate with high productivity.

[Translation done.]